Chapter-III

METHODOLOGY

The purpose of the study was to find out the effect of structured resistance training and varied intensities of weight training on selected motor fitness and physiological variables. The selection of subjects, selection of variables, research design, orientation of the subjects, selection of tests, testers reliability, training schedule, test administration, and the statistical technique used are dealt in this chapter

3.1 SELECTION OF SUBJECTS

To find out the effects of structured resistance training and varied intensities of weight training on selected motor fitness and physiological variables among college level athletes, the investigator randomly selected 60 sprinters, who competed at inter collegiate level sports meets representing different colleges in Andhra University and Acharya Nagarjuna University area in Andhra Pradesh.

They were divided into three groups at random again consisting twenty subjects in each group and they were randomly assigned as experimental group-I (SRT – Structured Resistance Training) and Experimental group II (VWT – varied weight training), and control group (CG).

The requirements of the experimental procedures, testing as well as exercise schedules were explained to them so as to avoid any ambiguity of the
effort required on their part and prior to the administration of the study, the investigator got the individual consent from each subject.

3.2 SELECTION OF VARIABLES

The research scholar reviewed the various scientific literature pertaining to the weight training and resistance training exercises on selected motor fitness and physiological variables from books, journals, periodicals, magazines and research papers. Taking into consideration of feasibility criteria, availability of instruments and the relevance of the variables of the present study, the following variables were selected.

3.2.1 Dependent Variables

3.2.1.1 Motor Fitness Variables

1. Speed
2. Agility
3. Flexibility
4. Cardiovascular Endurance

3.2.1.2 Physiological Variables

1. Resting Pulse Rate
2. Breath Holding Time
3. VO₂ max
3.2.2 **Independent Variables**

1. Structured Resistance Training (SRT) for twelve weeks
2. Varied Weight Training (VWT) for twelve weeks.

3.3 **EXPERIMENTAL DESIGN**

The study was formulated as a true random group design, consisting of a pre-test and post-test. The subjects (n=60) were randomly assigned to three equal groups of twenty men sprinters in each group. The groups were assigned as Experimental Groups-I, II, and control group respectively. Experimental group-I was assigned as Structured Resistance Training (SRT) and Experimental group-II was assigned as varied weight training (VWT) and control group. The control group was not given any special treatment except of their routine. Pre-tests were conducted for all the subjects on selected motor fitness and physiological variables, namely, speed, agility, flexibility, cardiovascular endurance, resting pulse rate, breath holding time and VO$_2$ max. The experimental groups participated in their respective training protocols for a period of twelve weeks.

The post-tests were conducted on the above said dependent variables after the experimental period of twelve weeks for all the three groups. The differences between the initial and final means on selected variables were considered. The obtained data were subjected to statistical treatment using ANCOVA. In all cases 0.05 level was fixed to test the hypothesis set for this study.
3.4 PILOT STUDY

A pilot study was conducted to assess the initial capacity of the subjects in order to fix the exercise load. For this purpose, ten sprinters who were not the subjects for this research were selected and weight training and resistance training were given to them.

Based on the response of the subjects in the pilot study, training programme to ensure the suitability, the loads and duration of exercise were scheduled. Further, the pilot study helped to know the subjects capacity, to know the satisfactory effects of exercises and to know the difficulty of conducting training programme and to set a clear understanding about the duration of time which was required for conducting the test.

Thus, training schedules for group-I and group-II were constructed. However, the individual differences were not considered. This enabled the investigator to adapt suitable training schedule for this study.

3.5 CRITERION MEASURES

The following criterion measures were adopted to measure the test.

1. To find out the effect of 50 meters run, conducted by using stop watch and the scores were recorded in seconds.

2. To find out the agility of the subjects 4 x 10 M shuttle run test was conducted and scores were recorded in seconds.
3. To find out the flexibility of the subjects sit and reach test was conducted and the scores were recorded in centimeters.

4. To find out the cardiovascular endurance, Harvard Step Up test was administered and the scores recorded in Physical Efficiency Index.

5. To find out the resting pulse rate, through the radial artery beats and counted in numbers per minute.

6. To find out the breath holding time, nose clippings and the stop watch were used to record the time.

7. To find out the VO₂ max, Cooper’s 12 Minutes Run / Walk test was conducted and the scores record based on the formulae suggested for this study.

3.6 RELIABILITY OF DATA

Before the commencement of experiment, the reliability of the data were established through reliability of instruments, reliability of tester, reliability of subjects by test and retest method

3.7 RELIABILITY OF INSTRUMENTS

The research scholar used the following instruments for measuring various tests, stop watch, measuring tape, starting clapper, nose clip, etcetera were used to find out the reliability of the instruments. Further, those instruments has been calibrated in standard units, each of the variables are
recorded. All the instruments were in good working condition. Their calibration were tested and found to be accurate enough to serve the purpose of the study.

3.8 TESTER’S RELIABILITY

To determine the reliability of measurements involved in this study, the data were collected from the subjects of three groups. To ensure that the investigator was well versed in the technique of conducting the tests, the investigator had a number of practice sessions in the testing procedures. The investigator took all the measurements with the assistance of persons well acquainted with the tests and their procedures. Tester’s competency and reliability of tests were established by Test, retest, process. As very high correlation was obtained, the tester competency in taking measurement and test reliability were accepted.

3.9 SUBJECT RELIABILITY

To determine the reliability of the subjects selected as subject and divided into three groups as control group, experimental group-I and experimental group-II. The test conducted for tester’s reliability ensured the subject reliability.

The correlation of coefficient correlation obtained for the tests variables were given in Table I.
Table I

Intra Class Correlation Coefficient of Test – Retest Scores

<table>
<thead>
<tr>
<th>S.No</th>
<th>Variables</th>
<th>Coefficient of Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed</td>
<td>0.93*</td>
</tr>
<tr>
<td>2</td>
<td>Agility</td>
<td>0.92*</td>
</tr>
<tr>
<td>3</td>
<td>Flexibility</td>
<td>0.82*</td>
</tr>
<tr>
<td>4</td>
<td>Cardiovascular Endurance</td>
<td>0.91*</td>
</tr>
<tr>
<td>5</td>
<td>Resting Pulse rate</td>
<td>0.87*</td>
</tr>
<tr>
<td>6</td>
<td>Breath Holding time</td>
<td>0.86*</td>
</tr>
<tr>
<td>7</td>
<td>VO₂ Max</td>
<td>0.88*</td>
</tr>
</tbody>
</table>

* Significant at 0.05 level

3.10 TRAINING PROGRAMME

The interventional treatment for experimental group-I, weight training exercises and experimental group-II resistance training were detailed below.

3.10.1 Resistance Training Group

This group also consisted of twenty subjects. They had six sessions per week for a total period of twelve weeks continuously without any break except on Sunday.
This investigation to find out the effect of structured resistance training specified training capsule for starting technique, strength and speed of performance of sprinters, selected the following exercises which were given to the experimental group for twelve weeks:

1. Partner Assisted Let-Go’s
2. Partner Tubbing-Assisted Acceleration Drill
3. Towed Running (Pulley)
4. Partner Resisted Starts
5. Weighted Starts

3.10.2 Training Capsule

The following training schedules were imparted to the experimental group to improve their starting techniques.

1. Partner Assisted Let-Go’s

Purpose

To teach quick transitions in speed and enhance stride frequency of acceleration.

Procedure

The subjects were asked to have a partner to use in his hands a towel to hold the subject at about a 45 degree forward lean. Then the subject was asked to start running, pumping the legs and arms explosively. The partner was allowed to let the subject go after about 5 strides. By this method, the subject
felt himself explode out of the falling position, using fast leg and arm movement to recover from the falling sensation.

2. Partner Tubbing-Assisted Acceleration Drill

**Purpose**

To improve quick leg recovery at first few steps and to enhance stride frequency during acceleration.

**Procedure**

Two sprinters were attached at the waist by a 10 to 20 yard rubber tubing. The assisting sprinter lined up at a distance 15 to 25 yards from the subject. The subject got into ready position of choice and explodes at the ‘go’ signal for 10 to 20 yards with the aid of the rubber tubing.

For longer acceleration runs, the assisting sprinter ran at the ‘go’ signal to provide continued assistance for a longer duration of run by the subject.

3. Towed Running (Pulley)

**Purpose**

To increase acceleration.

**Procedure**

Two sprinters were connected by a rope and pulley system that allows one sprinter to be towed while the other sprinter ran at half the speed of the towed sprinter. Thus, the towed sprinter ran faster than under normal conditions.
4. Partner Resisted Starts

Purpose

To enhance starting power and stride length.

Procedure

A partner resisted the subject during the first 8 to 10 strides. The resisting partner was situated in front of the running partner with the hands on the shoulders; or the resisting partner works from the back using hands or a towel around the waist of the running partner to resist the start and acceleration phase. This drill ends after 8 to 10 strides.

5. Weighted Starts

Purpose

To enhance elastic strength of start.

Procedure

The subject using a weighted vest, or shot belt enhanced the neural reflex of any start.

3.10.1.2 Various Weighted Balls

Various weighted balls were made by the investigator to improve strength of the subjects.
3.10.1.2 Materials Used for Training

The following materials were used for the training.

1. Iron Shoes with weights of 3 Kg, 3.5 Kg and 4 Kg.

2. Weight Jackets (4 kg, 5 kg and 6 kg).

3. Weights in forearms (1 kg, 1.5 and 2 kg).

Table II shows the schedule of Resistance Training for twelve weeks.
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Resistance Training Exercises</th>
<th>Variations</th>
<th>Time and Repetitions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Time   Reps</td>
</tr>
<tr>
<td>1</td>
<td>Partner Assisted Let GOs</td>
<td>Medium</td>
<td>4 mts 2</td>
</tr>
<tr>
<td>2</td>
<td>Partner Tubbing Assisted</td>
<td>Medium</td>
<td>4 mts 2</td>
</tr>
<tr>
<td></td>
<td>Acceleration Drills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Towed Running (Pulley)</td>
<td>Medium</td>
<td>4 mts 2</td>
</tr>
<tr>
<td>4</td>
<td>Partner Assisted Starts</td>
<td>Medium</td>
<td>4 mts 2</td>
</tr>
<tr>
<td>5</td>
<td>Weighted Starts</td>
<td>Medium</td>
<td>4 mts 2</td>
</tr>
<tr>
<td>6</td>
<td>Varied Weighted Iron Shoes</td>
<td>3 Kg</td>
<td>4 mts 2</td>
</tr>
<tr>
<td></td>
<td>(Running)</td>
<td>3.5 Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 Kg</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Weight Jackets (Running)</td>
<td>4 Kg</td>
<td>4 mts 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Kg</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 Kg</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Varied Weighted Forearm</td>
<td>1 kg in each hand</td>
<td>4 mts 2</td>
</tr>
<tr>
<td></td>
<td>Iron Plates (Running)</td>
<td>1.5 kg in each hand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 kg in each hand</td>
<td></td>
</tr>
</tbody>
</table>
3.11 WEIGHT TRAINING GROUP

This group consisted of twenty subjects. Three training sessions in a week for a period of twelve weeks were given. This group was directed to do 10 repetitions of each exercise and was also asked to do 3 sets in the beginning.

The load was increased by increasing the repetitions or sets after each week according to the ability of an individual. They were asked to do the exercises in pairs when one subject was doing exercises, the other subject was asked to help him. After completing one set, the next person was asked to do the same exercises.

The subjects were given equal amount of time to relax after each exercise. This programme consisted of the following eight exercises.

a. Military press
b. Barbell curls
c. Bench press
d. Lying Triceps Extension
e. Barbell Rows
f. Squats
g. Standing calf Raises
h. Leg Press

DESCRIPTION OF WEIGHT LIFTING EXERCISES

The description of the weight lifting exercises performed by the subjects of weight training are given below.
3.11.1 Military Press

Initial Position

The subject was asked to hold the bar a little more than shoulder width, palms facing away, with bar resting across the front of the shoulder.

Movement and Final Position

The subject was asked to push the barbell directly up past the face until arms locked out straight and the barbell was directly above the head. Slowly lowered the barbell back to the starting position and repeated the movements for the required numbers of repetitions.

Caution

Care was taken that the subject not to bend backward like press the weight upward, which will make the movements easier to complete.

Benefits

This exercise stresses the deltoids and triceps, with secondary emphasis on the upper pectorals, trapezius and back.

3.11.2 Barbell Curls

Initial Position

The subject stood erect with a shoulder-width grip on barbell, palms facing away from the body. Upper arms should be pinned to the sides of torso
throughout the movement. At the start of the movement, arms should be straight and the barbell should be resting across the upper thighs.

**Movement and Final Position**

Keeping the upper body straight, slowly raised the weight toward the chest, pause and returned slowly to the initial position.

**Caution**

Care was taken that the subject do not rock or move the upper body during this exercise, which is performed for bulking up the biceps. The subjects were asked to keep the biceps under tension throughout.

**Benefits**

This movement stresses the biceps and places secondary stress on the fore arms.

**3.11.3 Bench Press**

**Initial position**

The subject was asked to lie on the back on a flat exercise bench, took a slightly wider than shoulder-width on a barbell, palms facing upward. Arms should be straight and the barbell supported directly above the chest.
Movement and Final Position

Lowered the weight slowly till, it just touched chest and raised bar again to initial position, and the subject was asked to repeat the same for the suggested number of repetitions.

Caution

The subject was asked to perform it slowly with bouncing the weight; and asked to not deviate from the correct procedure so as to avoid injury.

Benefits

This exercise adds bulk to all chest muscles. Bench presses stress the pectorals, deltoids and triceps.

3.11.4 Lying Tricep Extension

Initial position

The subject was asked to take the same starting position as for the bench press, except that he should use narrow grip (six inches between the index fingers) in the middle of the barbell.

Movement and Final Position

Keeping the upper arms motionless, slowly bending the elbows the subject was asked to move the barbell in a semi-circular arc until it touched the forehead or went back over the end of the bench. Returned the barbell along the
same arch to the starting position and repeated for the required number of repetitions.

**Caution**

The subject was asked to perform it slowly with bouncing the weight; and asked to not deviate from the correct procedure so as to avoid injury.

**Benefits**

This movement places stress on the triceps.

### 3.11.5 Barbell Rows

**Initial Position**

The subject was asked to assume the position, keeping hands shoulder-width, bend over grasp the bar.

**Movement and Final Position**

Moving just forearms, bend the arms and the subjects were asked to move the barbell in a semi-circle from the thighs towards the chin. Slowly lowered the weight along the same arc back to the starting point and repeated.

**Caution**

The subject was asked to keep the upper body motionless when curl the weight. Lower the bar fully (arms hanging straight down) after having curled it
to the top of the movement. The subject was asked to perform a full motion each repetition.

**Benefits**

This movement stresses the biceps and places secondary stress on the forearms.

### 3.11.6 Squats

**Initial Position**

The subject stood erect with a barbell behind his neck, balancing it across the shoulders by grasping the bar knurls near the plates, placed the heels about 15-20 inches apart, toes angled slightly outward.

**Movement and Final Position**

The subject fixed the eyes on a point in front slightly above eye level and kept them there throughout the movement. Then slowly bent the knees and lower the body into a full squat, once the thighs had gone past parallel, then slowly rose up to the starting position.

**Caution**

The subjects were asked to keep the feet flat. To make the balance more secure by resting the heels on a 2 x 4 inch board during the movement.
Benefits

This is one of the best exercises you can do, because it affects most of the major muscle groups of the body. The squat works the thigh muscles, hips and buttocks, hamstrings and lower back. The abdominal muscles, upper back, calves and shoulders are stimulated too. Hence, it is called king of exercises.

3.11.7 Standing Calf Raises

Initial Position

The subject placed a barbell behind the neck, balancing it as did when performing a squat. Stood with toes and the balls of feet on a 4 x 4 inch or 2 x 4 inch block of wood. The feet should be about 8-10 inches apart.

Movement and Final Position

Keeping the legs straight, rose up as high as possible on toes. Lower slowly back to the starting point and repeated.

Caution

Care should be taken to balance and slowly rose up.

Benefits

This movement stresses the gastrocnemius and soleus muscles of calves.
3.11.8 Leg Press

Initial Position

The subject sat on the machine with back flat against the back rest and feet on foot plate about twelve inches apart, with toes pointing slightly outward. Griped the handles.

Movement and Final Position

The subject was asked to fold legs slowly bending the knees and moving them towards armpits. Let the weight came as low as possible and then pushed the weight back and extended legs fully to return to the initial position. Repeated the same for the desired number of repetitions.

Caution

Care was taken to see that the back and shoulders must remain flat against the back rest throughout, to work the inner thigh more, kept the legs apart a little more. Did it slowly that will help avoid injury to the knees.

Benefits

This is the best isolation movement for stressing the quadriceps.

The above exercises were demonstrated to the subjects and they were asked to do all these eight exercises in eight different stations. They were asked to do all these exercises on rotation. The stations were arranged at the
convenient distance and the subjects were directed to change the station after each exercise.

**Varied Intensities**

Intensities of the Weight Training were arranged from low, medium and high. For first three weeks, 10 repetitions of each weight training exercises with 3 sets were given. For the next two weeks, the sets were increased from 3 to 4. For VI to VIII the subjects were asked to perform 15 repetitions with 4 sets and at the final phase of IX to XII weeks the subjects performed 20 repetitions with 4 sets. Thus, the subjects were provided with varied intensities of weight training.

The training Schedule for Varied Intensities of Weight Training Exercises are presented in Table III.
Table III

Work load schedule for Varied Weight Training Group

<table>
<thead>
<tr>
<th>S.No.</th>
<th>r over time. eatine</th>
<th>Repetitions and Sets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Reps</td>
</tr>
<tr>
<td>1</td>
<td>Military Press</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Barbell Curls</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Bench Press</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Lying Triceps Extension</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Barbell Rows</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Squats</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Standing Calf Raises</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>Leg Press</td>
<td>10</td>
</tr>
</tbody>
</table>
3.12 MEASUREMENT OF MOTOR FITNESS VARIABLES

3.12.1. Speed (50 Meters)

Purpose

To measure the speed.

Materials used

Two stop watches, measuring tape, clapper, track marking 50 meters.

Instruction

The subjects were advised to run in their own line from the starting to finish, with maximum speed. The command used for starting was ‘on your mark’, ‘set’, ‘clap’.

Procedure

Two lines were marked 50 meters apart from the starting line and finish line. On the command, ‘clapp’, the subject ran as fast as possible across, the finish line to cover 50 meters area.

Scoring

The elapsed time was measured to the nearest one tenth of a second.
3.12.2 Agility (Shuttle Run 4 x 10 meters)

Objective

To measure the agility of the performer in running and changing direction

Apparatus used

Stopwatch, measuring tape, 2 blocks of wood.

Procedure

Two parallel lines were marked 10 meter apart as starting line and end line.

Two blocks were placed behind the end line at the time of start. The performer on the signal go, ran to the blocks, picked up one returned to the starting line and placed the block behind the line. He repeated the same process with second block.

Scoring

The score for each performer was the time required to complete 60 meter and recorded to nearest one tenth of a second.
3.12.3 Flexibility (Sit And Reach)

Purpose

To estimate the trunk flexibility.

Equipments

Yardstick and measuring steel tape.

Procedure

Place the yardstick on the floor and put an 18 inch piece of tape across the 15 inch mark on the yardstick. The tape should secure the yardstick to the floor. The subject sits with the O end of the yardstick between the legs. The subject heel should almost touch the tape at the 15 inch mark and be about 12 inch apart with the legs held straight. The subject bends forward slowly and reaches with parallel hand as far as possible and touches the yardstick. The subject should hold this reach long enough for the distance to be recorded.

Scoring

The best score recorded out of the three trials was the score in flexibility.
3.12.4 Cardiovascular Endurance

Harvard Step Test

Purpose

To measure the cardio respiratory endurance through Physical Efficiency Index.

Equipments

A stable bench 20 inches high and a stop watch.

Procedure

The subject step up and down 30 times a minute on a bench 20 inches high. Each time, the subject should step all the way up on the bench with the body erect. The stepping process is performed in four counts, as follows: 1. one foot is placed on bench, 2. other foot is placed on the bench; 3. one foot is placed on the floor; 4. the other foot is placed on floor. The tester may lead off with the same foot each time or any change feet as she desires, so long as the four count step is maintained. The steps were counted the cadence as ‘up, up, down, down’.

The stepping exercise continues for exactly five minutes, unless the subject is forced to stop sooner due to exhaustion. In either case, the duration of
the exercise in seconds is recorded; the maximum number of seconds is 300 for the full five minute period.

Immediately after completing the exercise, the subject sits on a chair.
The pulse is counted 1 – 1½, 2 – 2½ and 3 – 3½ minutes after the stepping ceases.

**Scoring**

A physical efficiency index (PEI) is computed utilizing the following formula:

\[
\text{PEI} = \frac{\text{Duration of Exercise in Seconds} \times 100}{2 \times \text{Sum of pulse counts in recovery}}
\]

### 3.13 MEASUREMENT OF PHYSIOLOGICAL VARIABLES

#### 3.13.1 Resting Pulse Rate

**Objective**

The purpose of this test was to record the number of heart beat per minute.

**Equipment**

A stop watch (1/100 of a second) and a chair.
**Procedure and Scoring**

The resting heart rate of all the subjects was recorded in sitting position in the morning session. Before taking the resting heart rate, the subjects were asked to sit in a chair inside a room and relax for 20 minutes. To record the heart rate, finger tips were placed on the radial artery at the subjects wrist in such a manner that palpation was clear and the number of palpation was counted for one minute.

**3.13.2 Breath Holding Time**

**Objective**

The purpose of this test was to measure the breath holding time.

**Equipments**

For recording the breath holding time, a stop watch (1/10\(^{th}\) of second) and nose clip were used.

**Administration**

The subject was instructed to stand at ease and to inhale deeply after which he holds his breath for a length of time possible by him. A nose clip was placed on nose to avoid letting the air through nostrils. The duration from the time of holding his breath, until the movement, he let air out was clocked by using the stop watch to the nearest one tenth of a second as breath holding time.
The co-operation of the subject to let out the air by opening the mouth was sought to clock the exact breath holding time.

**Scoring**

The time is recorded in seconds and the beset of two trials were recorded (Donald K. Mathew, 1988).

3.13.3 \textit{VO}_2 \textit{Max (Cooper’s) 12 Minutes Run or Walk Test}

**Purpose**

To measure the \textit{VO}_2 \textit{max} (cardio respiratory endurance)

**Equipment**

Whistle, stopwatch, 400 meters track.

**Description**

Subjects assemble behind the starting line. at the starting signal, they, run or walk as far as possible with in the 12 minutes time limit. An experienced pacer should accompany performers around the running area during the actual test. At the signal ‘to stop ‘performers should remain’ where they finished long enough for test administrators to record the distance covered. Ample time should be given for stretching and warm-up as well as cool down.
Scoring

The distance in meters covered in 12 minutes.

The \( \text{VO}_2 \max \) in ml/min/kg was calculated based on the formulae suggested by Cooper (1960) was:

\[
\text{VO}_2 \max = \frac{d_{12} - 505}{45}
\]

Where, \( d_{12} \) is the distance (in meters) covered in 12 minutes.

3.14 STATISTICAL ANALYSIS

In this experimental study, the subjects were tested prior to and after the experimental period and hence the Analysis of Co-Variance (ANCOVA) as described by Clarke and Clarke (1972) was used:

\[
F = \frac{(MS_{vx})_b}{(MS_{yx})_w}
\]

The Scheffe’s post, hoc analysis test was also applied to ascertain the significant difference between the adjusted means of experimental group-I and experimental group-II by Clarke and Clarke (1972).

\[
F = \frac{(M_1 - M_2)}{(MS_w/((1/n) + (1/n)))}
\]